UNITED STATES DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration
~~NATIONAL MARINE FISHERIES SERVICE~~ National Marine Fisheries Service
Northwest and Alaska Fisheries Center
Resource Assessment and Conservation
Engineering Division
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CRUISE RESULTS
Charter Vessel MORNING STAR
Cruise No. MS 85-1
Eastern Bering Sea Walleye Pollock
Echo Integrator-Midwater Trawl Survey
May 21 - September 3, 1985

During June 6 to August 24, the MORNING STAR, a 37 m western style crabber/stern trawler, completed an acoustic echo integrator-midwater trawl survey of the eastern Bering Sea pollock resource. The survey was conducted as part of the National Marine Fisheries Services's triennial groundfish assessment survey. Pollock target strength data were collected during the survey when suitable conditions were encountered. Operations extended from the Bristol Bay/Unimak Pass area northwest to approximately 61° 30'N, 174°W and between the 15 and 250 fathom isobaths.

ITINERARY

May 21-24	Acoustic system calibration using the University of Washington's calibration barge. Data collection system and trawl gear testing in Puget Sound.
May 24-June 6	Transit to Dutch Harbor, Embark scientists.
June 6-29	Leg I - Initiation of echo integration survey of juvenile and adult pollock (greater than age 0)and collection of target strength data at selected locations from the Bristol Bay/Unimak Pass area northwest to the Pribilof Islands.

July 1-29	Leg II - continuation of adult and juvenile pollock survey and the collection of pollock target strength data in the area between the Pribilof Islands and 61° 30'N, 174°W. Completion of standard target calibration tests.
Aug. 1-21	Leg III - Completion of age 0 pollock survey and target strength data collection between Unimak Pass and 61° 30'N, 174°W.
Aug. 21-24	Completion of joint operations with the U.S. charter vessel ARGOSY and Japanese charter vessel DAIKICHI MARU #32 involving an on-bottom and midwater survey of a small area southeast of the Pribilof Islands. Return to Dutch Harbor.
Aug. 26-Sept. 3	Transit to Seattle; calibration of acoustic equipment using University of Washington's calibration barge.

OBJECTIVES

The primary objectives of this survey were to: 1) collect data necessary to estimate the distribution, biomass and biological composition of the off-bottom component of the pollock (greater than age 0) resource of the shelf and upper slope area; 2) collect target strength measurements of pollock; 3) collect data on the distribution and abundance of age 0 pollock in the shelf area, and 4) carry out a field calibration of the acoustic system using standard calibration spheres.

ACOUSTIC EQUIPMENT AND TRAWL GEAR

Acoustic data were collected using a van-contained, computerized echo integration and target strength measurement system, with an operating frequency of 38 kHz, housed in a 16 ft high X 10.5 ft wide X 10 ft high cargo container. The system included a 38 kHz echo sounder used with a multi-beam transducer. The transducer was mounted in a deadweight body towed at a depth of 10-15 m behind the vessel. The system was configured to complete echo integration and dual beam target strength analysis. During the latter portion of the survey, a system with split beam target strength measurement capability was added.

Sampling of adult and juvenile pollock was accomplished with a large, square, midwater trawl (Diamond 1000) with headrope, footrope, and breastline lengths of 53.9 m (177 ft) and stretched

mesh sizes ranging from 813 mm (32 inches) forward to 89 mm (3.5 inches) in the codend. The codend was equipped with a 31.7 mm (1.25 inch) liner. This trawl was fished with two 125 kg (275 lb.) tom weights and two 1.8 x 2.1 m (5x7 ft) V-doors. Trawl position was determined using a cable netsounder which indicated that the trawl's vertical mouth opening averaged between 16.5 and 18.5 meters (54 to 61 ft).

Age 0 pollock and other small fish were sampled with a smaller mid-water trawl (Marinovich trawl) which was fished with the same V-doors and net sounder as the Diamond 1000. This trawl had a square mouth opening with head rope, foot rope, and breastline lengths of 9.1 m (30 ft) and stretched mesh sizes ranging from 76 mm (3 inches) forward to 31.7 mm (1.25 inches) in the codend. The last third of the codend was equipped with a 3.2 mm (.125 inch) knotless nylon liner. The average vertical mouth opening of the trawl was about 5.5 meters (18 feet).

SURVEY METHODS

During Legs I and II, operations were conducted 24 hours per day along a systematic trackline consisting of parallel transects between the 15 fathom and 250 fathom isobaths (Fig. 1). The transducer was towed at a mean depth of 18 m at an average speed of 9 kts. Density estimates in kg/m^2 from the echo integration system were output at one minute intervals for up to 400 one meter depth intervals from the transducer and in each of 40 one meter bottom referenced intervals. Target strength measurements of adult pollock were obtained when conditions suitable for single target recognition were encountered. Midwater trawl hauls were made throughout the survey area including target strength data collection sites.

Data on the distribution and abundance of age 0 pollock were collected during Leg III of the cruise (Aug. 1-21). Operations were again conducted 24 hours per day. The survey trackline consisted of 9 transects spaced at intervals of 60 nm (Fig. 1). Trawl hauls, which were made with the Marinovich trawl, were located at systematically selected locations along each transect. Opportunistic trawl hauls were also made at selected locations. During August 21-24, joint operations were carried out with the Japanese charter vessel DAIKICHI MARU #32 involving an on-bottom and midwater survey of a small area southeat of the Pribilof Islands and designed to examine diurnal changes in the on-bottom/ off-bottom distribution of pollock.

On July 26, while anchored in Makushin Bay near Dutch Harbor, calibration data were collected using a standard calibration sphere suspended below the transducer. Target strength measurements were made of the standard target with the split beam and dual beam systems. These data will be used to aid in evaluation of the accuracy of acoustic calibration data obtained with hydrophones.

RESULTS

During Legs I and II, June 6 to July 20, the MORNING STAR surveyed a 5,222 nm trackline which consisted of 29 parallel transects (Fig. 1). A total of 90 hauls was completed during Legs 1 and 2 (hauls 1-90); 73 with the Diamond 1000 trawl and 17 with the Marinovich trawl. During Leg 3, 51 trawl hauls were completed (5 with the Diamond 1000 and 46 with the Marinovich trawl). A list of species caught is provided in Tables 1 and 2. Catch and haul data are summarized in Tables 3 and 4.

The highest densities of pollock age 1 and older were in the area of 59°-60°N, 174°-178°W. The average length of the pollock in this region was smaller than the remainder of the survey region due to the presence of a large number of age 1 and 2 fish in this high density region.

During Leg III, the trackline on which the age 0 pollock survey was conducted was 2,490 nm long and included 9 parallel transects (Fig. 1). As in all previous surveys of age 0 pollock, pollock was the dominant species by number and jellyfish the dominant species by weight.

SCIENTIFIC PERSONNEL

LEG I

Jimmie Traynor	Chief Scientist
Wayne Haight	Biological Technician
Robert Loughry	Biological Technician
Douglas Smith	Fishery Biologist
Dan Twohig	Electronics Technician

LEG II

Jimmie Traynor	Chief Scientist
John Garrison	Electronics Technician
Wayne Haight	Biological Technician
Jim Seger	Biological Technician
Dan Twohig	Electronics Technician
Neal Williamson	Statistician

LEG III

Neal Williamson	Chief Scientist
Kevin Li	Biological Technician
Jim Seger	Biological Technician
Douglas Smith	Fishery Biologist
Dan Twohig	Electronics Technician

Table 1.--Species captured in trawl hauls during MORNING STAR Cruise 85-1, Legs 1 & 2.

Taxa	Common name	Scientific name	Occurrence (no;. hauls)	Total catch (lbs)	Method of capture: Marinovich	Method of capture: Diamond
	Fish larvae (unident.)		8	0.8	8	
Petromyzontidae	Pacific lamprey	Lampetra tridentata	3	5.2	1	2
Rajidae	Aleutian skate	Bathyraja aleutica	3	5.0	1	2
Pleuronectidae	Flathead sole	Hippoglossoides elassodon	1	0.5		1
Pleuronectidae	Yellowfin sole	Limanda aspera	12	36.0	3	9
Pleuronectidae	Rock sole	Lepidopsetta bilineata	1	7.0		1
Pleuronectidae	Alaska plaice	Pleuronectes quadrituberculatus	3	39.0		3
	Flatfish larvae		11	1.1	11	
Ammodytidae	Pacific sand lance	Ammodytes hexapterus	4	0.4	3	1
Clupeidae	Pacific herring	Clupea harengus pallasi	2	0.8		2
Cottidae	Yellow Irish lord	Hemilepidotus jordani	2	6.0		2
Cottidae	Great sculpin	Myoxocephalus polyacanthocephalus	3	18.0		3
Cyclopteridae	Lumpsucker (unident.)		1	0.1	1	
Cyclopteridae	Smooth lumpsucker	Aptocyclus ventricosus	1	2.0		1
Cyclopteridae	Snailfish (unident.)		1	0.1	1	
Trichodontidae	Pacific sandfish	Trichodon trichodon	2	0.8	1	1
Gadidae	Pacific cod	Gadus macrocephalus	13	238.5		13
Gadidae	Walleye pollock	Theragra chalcogramma	78	60698.7	6	72
Gadidae	Walleye pollock juvenile	Theragra chalcogramma (juv.)	22	852.8	15	7
Myctophidae	Laternfish (unident.)		3	1.5	2	1
Osmeridae	Smelt (unident.)		1	0.1		1
Osmeridae	Eulachon	Thaleichthys pacificus	5	12.4		5
Osmeridae	Capelin	Mallotus villosus	2	17.3	1	1
Salmonidae	Chinook salmon	Oncorhynchus tshawytscha	3	12.0		3
Scyphozoa	Jellyfish (unident.)		44	6072.7	13	31
Metridium	Sea anemone (unident.)		1	1.0		1
	Ctenophora		5	5.2	3	2
Amphipoda	Amphiphod (unident.)		6	0.6	6	
Euphausiacea	Euphausiid (unident.)		1	2.0	1	
Copepoda	Copepod (unident.)		1	0.1	1	
Decapoda	Shrimp (unident.)		3	0.3	3	
Cephalopoda	Octopus (unident.)		1	0.1	1	
Cephalopoda	Squid (unident.)		7	1.5	5	2
Cephalopoda		Berryteuthis magister	3	1.2		3
	Salps (unident.)		1	0.5		1
	Sea potato (unident.)		1	1.0		1

Table 2.--Species captured in midwater trawl hauls during MORNING STAR Cruise 85-1, Leg 3.

Taxa	Common name	Scientific name	Occurrence (no. hauls)	Total catch (lbs)	Method of capture	
					Marinovich	Diamond
	Fish larvae (unident.)		9	0.1	9	
	Fish (unident.)		1	0.0	1	
Pleuronectidae	Arrowtooth flounder	Atheresthes stomias	1	1.5		1
Pleuronectidae	Flathead sole	Hippoglossoides elassodon	1	1.5		1
Pleuronectidae	Yellowfin sole	Limanda aspera	2	8.0	2	
	Flatfish (unident.)		1	0.4	1	
	Flatfish larvae		11	0.3	11	
Agonidae	Sturgeon poacher	Agonus acipenserinus	5	0.6	5	
Ammodytidae	Pacific sand lance	Ammodytes hexapterus	7	0.2	7	
Clupeidae	Pacific herring	Clupea harengus pallasi	3	19.2		3
Cottidae	Sculpin (unident.)		1	0.0	1	
Cottidae	Red Irish lord	Hemilepidotus hemilepidotus	1	1.9	1	
Trichodontidae	Pacific sandfish.	Trichodon trichodon	1	0.4	1	
Gadidae	Pacific cod	Gadus macrocephalus	17	55.9	15	2
Gadidae	Walleye pollock	Theragra chalcogramma	20	1884.2	15	5
Gadidae	Walleye pollock juvenile	Theragra chalcogramma (juv.)	42	188.7	42	
Cyclopteridae	Snailfish (unident.)		6	0.8	6	
Osmeridae	Capelin	Mallotus villosus	1	0.0	1	
Stichaeidae	Prickleback (unident.)		5	0.1	5	
Scyphozoa	Jellyfish (unident.)		48	2584.1	44	4
Amphipoda	Amphiphod (unident.)		12	0.4	12	
	Isopod (unident.)		1	0.0	1	
Euphausiacea	Euphausiid (unident.)		18	13.2	18	
Decapoda	Shrimp (unident.)		4	0.3	4	
	Crab (unident.)		9	0.6	9	
Cephalopoda	Squid (unident.)		10	2.2	7	3
Ascidian	Tunicate (unident.)		1	0.2	1	

Table 3.--Trawl haul station and catch data MORNING STAR 1985.

DIAMOND TRAWL HAULS

Haul No.	Date (1985)	Start Pos. Lat (N)	Long (W)	Time of Day (local)	Depth (fm) Gear/ Bottom	Temp (°C) Surface/ Gear	Duration (hr)	CATCH (lbs) Pollock (Age 0)	Pollock (>Age 0)	Pacific cod (Age 0)	Pacific cod (>Age 0)	Jelly-fish unident.	Other species
001	6/04	54°16'	166°59'	1314	64/600	5.0/4.1	1.07	-	51.8	-	-	0.2	0.6
003	6/08	56°03'	162°13'	0900	39/40	3.4/3.0	1.00	-	787.0	-	-	78.0	6.3
004	6/09	56°04'	163°22'	1631	43/48	3.9/3.0	0.18	-	191.0	-	-	351.0	2.0
005	6/10	56°00'	162°47'	0530	39/44	3.7/3.0	1.00	-	204.0	-	-	1226.0	1.5
006	6/10	55°44'	162°54'	1141	29/34	3.7/3.0	1.12	-	409.0	-	-	1500.0	11.3
007	6/11	55°09'	164°35'	1024	29/45	4.8/4.0	0.83	-	<989.7	-	-	1361.0	1.7
009	6/13	55°28'	165°47'	0847	36/65	4.8/3.5	0.67	-	654.0	-	-	260.0	-
010	6/13	54°39'	165°45'	2229	27/185	5.0/3.4	1.00	-	773.0	-	-	6.0	0.1
011	6/14	55°58'	166°26'	2227	35/69	6.0/3.9	0.90	-	432.0	-	-	4.0	-
013	6/15	54°58'	166°55'	1647	39/90	5.8/4.0	0.50	-	318.0	-	-	7.0	0.2
014	6/16	57°49'	167°08'	1247	33/35	1.6/0.4	0.38	15.0	5.0	-	-	6.0	41.1
015	6/17	56°35'	167°39'	0941	47/59	5.0/4.0	1.00	-	4453.0	-	12.0	5.0	-
017	6/19	56°57'	168°56'	1200	43/44	4.6/2.4	0.17	-	1358.0	-	-	78.0	1.5
018	6/19	56°25'	168°52'	1638	55/64	5.5/5.3	1.70	-	2208.0	-	11.5	2.0	1.0
019	6/20	56°44'	169°30'	1935	39/43	5.0/4.2	0.13	-	693.0	-	-	45.0	-
021	6/21	57°33'	169°38'	1553	39/40	5.1/2.4	1.00	0.2	643.0	-	5.0	-	40.0
022	6/23	56°58'	170°46'	1122	48/55	5.3/5.2	0.50	-	<096.0	-	12.0	107.0	-
023	6/23	57°35'	170°54'	1654	44/46	5.3/3.5	1.00	-	814.0	-	-	17.0	6.0
024	6/24	57°56'	171°35'	1407	49/54	5.3/3.8	1.00	-	<129.0	-	-	25.0	-
025	6/24	57°20'	171°28'	2035	50/55	5.7/3.8	0.67	-	840.0	-	14.0	20.0	-
026	6/25	56°18'	171°20'	0635	62/125	6.1/5.1	1.02	-	99.0	-	-	-	-
027	6/25	56°45'	170°07'	1347	37/49	5.4/4.7	1.00	-	613.0	-	-	656.0	6.0
028	6/26	57°26'	168°58'	0851	38/39	5.5/4.7	0.50	0.1	1183.0	-	19.0	-	11.5
029	6/27	56°47'	168°17'	0818	49/54	5.1/1.5	0.18	-	<219.0	-	-	17.0	-
030	6/27	55°01'	169°01'	2332	9/1000	6.3/4.3	1.10	-	79.0	-	-	-	1.0
031	6/28	55°55'	168°12'	0940	71/79	6.5/4.4	0.67	-	44.0	-	-	-	-
032	6/28	55°57'	168°12'	1152	74/81	6.5/4.6	0.23	-	968.0	-	-	-	-
033	6/28	55°36'	167°34'	1640	72/75	6.0/4.5	0.68	-	2444.8	-	12.0	-	0.7
034	7/03	57°24'	172°07'	1615	59/60	6.4/2.6	0.33	-	1595.0	-	7.0	13.0	-
037	7/04	59°19'	173°08'	2052	54/56	5.0/1.2	0.50	81.0	256.0	-	-	-	6.0
038	7/05	58°11'	172°55'	0820	48/60	5.8/2.4	0.80	-	1344.0	-	-	24.0	-

Table 3.--continued.

DIAMOND ~~TRAWL~~ ~~HAULS~~

Haul No.	Date (1985)	Start Pos. Lat (N)	Long (W)	Time of day (local)	Depth (fm) Gear/ Bottom	Tap (°C) Surface/ Gear	Dura-tion (hr)	CATCH (lbs) Pollock (Age 0)	Pollock (>Age 0)	pacific cod (Age 0)	Pacific cod (>Age 0)	Jelly-fish unident.	Other species
040	7/05	57°47'	172°50'	1345	60/64	6.3/2.7	1.83	-	485.0	-	10.0	-	0.5
041	7/06	57°58'	173°28'	1235	63/65	6.3/3.7	0.23	-	778.0	-	-	-	-
043	7/06	58°43'	173°39'	1922	67/69	6.3/5.2	0.22	-	1520.0	-	-	-	-
044	7/07	59°36'	174°25'	1640	15/64	5.9/4.8	0.17	-	2158.0	-	-	-	-
045	7/07	59°34'	174°27'	1815	55/65	5.9/1.5	0.50	-	1421.0	-	-	-	-
047	7/08	59°24'	175°06'	1316	48/73	5.8/2.0	0.07	-	735.0	-	-	-	-
048	7/08	60°00'	175°16'	1818	64/65	5.8/1.5	0.45	-	1645.0	-	24.0	-	2.0
050	7/10	61°29'	177°15'	0007	50/66	5.2/0.5	1.00	-	606.0	-	-	-	10.0
051	7/10	61°27'	177°15'	0905	56/67	5.2/0.5	1.00	-	481.0	-	-	-	-
053	7/10	60°45'	176°51'	1656	60/70	5.6/0.9	0.33	-	571.0	-	-	-	-
054	7/11	59°45'	176°35'	0837	48/76	5.8/1.2	0.28	49.0	346.0	-	-	-	-
055	7/11	59°47'	176°36'	0929	56/76	5.8/1.0	0.13	648.0	1097.0	-	-	-	-
056	7/11	59°48'	176°37'	1023	25/77	5.8/1.5	0.35	51.0	623.0	-	-	-	-
057	7/11	58°53'	176°17'	2030	58/71	6.8/1.5	0.17	-	1936.0	-	-	-	1.0
059	7/12	59°18'	175°45'	1054	57/76	6.2/1.0	0.33	-	703.0	-	-	-	-
060	7/12	59°58'	175°56'	1644	64/71	6.1/1.6	0.20	-	572.0	-	-	-	-
061	7/13	60°15'	177°21'	1622	76/78	6.5/1.0	0.20	-	975.0	-	-	-	-
062	7/13	59°19'	177°04'	2358	25/84	7.0/2.5	0.53	-	132.0	-	-	-	-
063	7/14	59°55'	177°54'	1653	76/79	6.7/1.2	0.25	-	950.0	-	15.0	-	-
065	7/15	60°20'	178°03'	1134	77/85	6.8/2.0	0.25	-	608.0	-	-	-	-
066	7/15	60°38'	177°33'	1437	70/84	6.7/0.8	0.25	-	2098.2	-	-	-	-
067	7/15	60°12'	176°43'	1913	67/78	6.8/1.8	0.17	-	659.0	-	-	-	-
068	7/16	59°54'	176°43'	0806	65/77	6.7/1.0	0.17	-	1138.0	-	-	-	-
069	7/16	59°53'	177°10'	1012	73/75	6.6/0.5	0.18	-	601.0	-	-	-	-
070	7/16	59°37'	177°06'	1240	42/100	6.6/1.5	0.53	-	417.0	-	-	-	-
071	7/16	59°25'	176°26'	1628	65/76	7.5/1.4	0.13	-	1284.0	-	-	-	-
072	7/16	59°09'	176°21'	1854	70/78	7.8/1.5	0.32	-	1163.0	-	-	-	-
073	7/17	59°40'	175°53'	0747	65/77	7.3/1.5	0.25	-	688.0	-	-	-	-
074	7/17	59°00'	174°20'	1545	64/71	6.7/2.0	0.25	-	342.0	-	-	-	-
075	7/17	58°60'	174°22'	1632	16/70	6.7/3.0	0.50	-	-	-	-	2.0	5.0
077	7/18	58°42'	174°17'	2023	73/83	7.3/2.7	0.20	-	975.0	-	14.0	-	-

Table 3.--continued.

DIAMOND TRAWL HAULS

Haul No.	Date (1985)	Start Pos. Lat (N)	Start Pos. Long (W)	Time of day (local)	Depth (fm) Gear/ Bottom	Temp (°C) Surface/ Gear	Duration (hr)	CATCH (lbs) Pollock (Age 0)	Pollock (>Age 0)	Pacific cod (Age 0)	Pacific cod (>Age 0)	Jelly-fish unident.	Other species
078	7/18	58°41'	174°23'	1138	90/90	7.4/3.0	0.33	-	2464.2	-	83.0	-	-
079	7/21	56°51'	173°20'	0531	85/100	8.3/3.5	0.75	-	4.0	-	-	2.0	-
080	7/21	56°52'	173°19'	0705	105/108	8.3/3.4	0.50	-	4.0	-	-	2.0	-
081	7/22	54°15'	173°57'	1945	108/2000	7.8/2.9	2.00	-	6.0	-	-	2.0	-
082	7/23	52°43'	173°52'	0839	82/1000	7.2/3.6	2.00	-	20.0	-	-	-	-
083	7/24	52°59'	171°33'	0212	69/1000	5.3/4.4	1.00	-	234.0	-	-	3.0	0.1
084	7/24	52°59'	171°26'	1935	102/1000	6.4/4.2	0.87	-	35.0	-	-	-	-
085	7/24	52°59'	171°22'	2305	71/1000	6.4/4.3	1.92	-	33.0	-	-	12.0	-
087	7/25	54°15'	167°03'	0932	85/700	9.8/4.0	1.75	-	40.9	-	-	4.0	0.7
088	7/27	54°17'	167°01'	0321	75/500	10.0/4.0	1.82	-	80.0	-	-	28.5	21.5
090	7/28	54°55'	166°11'	1814	77/80	9.0/3.8	0.33	-	1095.0	-	-	-	1.0
091	8/01	54°54'	166°07'	1921	72/80	9.0/4.0	0.66	-	774.0	-	-	-	-
092	8/02	54°54'	166°09'	0244	73/80	9.0/4.0	0.53	-	489.0	-	-	4.0	4.0
137	8/22	56°33'	168°39'	0611	52/60	8.6/-	0.17	-	546.0	-	53.0	38.0	2.0
138	8/22	56°33'	168°41'	0653	18/59	8.6/-	0.50	-	0.5	<.1	-	150.0	0.4
139	8/22	56°38'	168°39'	1822	58/60	8.4/-	0.53	0.3	2.2	-	-	30.1	0.1

Table 4.--Trawl haul station and catch data, MORNING STAR 1985

MARINOVICH ~~TRAWL~~ ~~HAULS~~

Haul No.	Date (1985)	Start Pos. Lat (N)	Long (W)	Time of day (local)	Depth (fm) Gear/ Bottom	Temp (°C) Surface/ Gear	Duration (hr)	CATCH (lbs) Pollock (Age 0)	Pollock (>Age 0)	Pacific cod (Age 0)	Pacific cod (>Age 0)	Jelly-fish unident.	Other species
002	6/07	57°38'	159°39'	0815	08/27	2.5/2.5	1.00	-	-	-	-	-	0.6
008	6/11	55°07'	164°34'	1209	08/45	4.8/4.2	1.00	0.1	67.0	-	-	110.0	7.5
012	6/14	56°00'	166°26'	2351	09/70	6.0/3.9	0.60	0.1	5.0	-	-	1.0	1.1
016	6/19	57°28'	169°00'	0759	09/39	5.0/2.6	0.50	0.1	-	-	-	43.0	0.7
020	6/21	57°34'	169°38'	1442	19/39	5.1/5.1	0.50	-	-	-	-	4.0	0.2
035	7/03	57°22'	172°06'	1713	17/60	6.4/4.0	0.50	2.0	0.1	-	-	19.0	0.2
036	7/04	59°17'	173°09'	1938	18/56	5.0/3.0	0.50	2.1	-	-	-	-	0.1
039	7/05	58°13'	172°56'	0920	18/60	5.8/4.0	0.50	0.1	-	-	-	8.0	1.5
042	7/06	57°57'	173°28'	1328	14/66	6.3/5.0	0.50	0.3	-	-	-	5.0	2.4
046	7/07	59°34'	174°27'	2123	16/65	5.9/4.0	0.50	0.7	-	-	-	3.0	0.3
049	7/08	59°59'	175°15'	1918	16/65	5.8/3.0	0.50	1.6	-	-	-	1.0	0.2
052	7/10	61°30'	177°14'	1014	11/66	5.2/4.0	0.53	0.1	-	-	-	-	0.2
058	7/11	58°56'	176°17'	2109	15/71	6.8/3.0	0.50	0.1	3.5	-	-	2.0	0.1
064	7/14	59°54'	177°57'	1741	11/79	6.7/3.0	0.50	0.1	-	-	-	2.0	0.3
076	7/17	58°60'	174°26'	1728	17/70	6.7/3.0	0.50	0.9	-	-	-	-	0.3
086	7/24	52°59'	171°26'	2346	80/1000	6.4/4.3	1.00	0.1	2.5	-	-	5.0	0.3
089	7/27	54°14'	167°06'	0554	83/500	10.0/3.9	0.77	0.1	4.0	-	-	6.0	2.4
093	8/02	54°55'	165°20'	1440	62/69	8.1/5.5	0.58	<0.1	1.0	-	-	4.2	<0.1
094	8/02	55°34'	163°50'	2338	11/47	9.2/6.5	0.50	0.2	6.0	<0.1	-	284.0	<0.1
095	8/03	56°11'	162°18'	0850	11/41	9.8/6.5	0.33	0.1	10.0	<0.1	-	566.0	-
096	8/03	56°49'	160°46'	1712	17/35	9.8/3.8	0.38	0.5	1.6	<0.1	-	73.0	<0.1
097	8/04	57°27'	159°10'	0200	17/27	7.0/7.0	0.33	1.4	<0.1	-	-	37.8	1.5
098	8/04	57°51'	161°17'	1658	16/24	7.9/4.9	0.30	15.6	-	-	-	0.2	2.5
099	8/04	57°16'	162°46'	2357	9/28	9.0/4.0	0.25	0.7	-	-	-	2.1	0.1
100	8/05	56°40'	164°13'	0705	15/40	9.4/1.5	0.50	8.2	-	0.3	-	79.0	-
101	8/06	56°06'	165°39'	1458	22/52	9.8/4.9	0.57	6.6	-	0.4	-	171.2	-
102	8/06	56°21'	168°03'	1337	18/79	9.2/4.4	0.55	2.7	-	<0.1	-	11.7	<0.1
103	8/06	56°49'	166°55'	2012	13/44	9.1/4.0	0.22	6.8	-	0.2	-	216.0	<0.1
104	8/07	57°17'	165°44'	0151	7/37	-/8.6	0.33	1.9	-	1.1	-	43.4	0.1
105	8/07	57°45'	167°37'	1918	13/27	-/-	0.50	0.5	-	0.1	-	0.3	0.1
106	8/08	58°13'	163°23'	0114	12/22	7.8/7.0	0.30	1.3	-	-	-	-	7.3

Table 4.--continued

MARINOVICH TRAWL HAULS

Haul No.	Date (1985)	Start Pos. Lat (N)	Long (W)	Time of day (local)	Depth (fm) Gear/ Bottom	Temp (°C) Surface/ Gear	Duration (hr)	CATCH (lbs) Pollock (Age 0)	Pollock (>Age 0)	Pacific cod (Age 0)	Pacific cod (>Age 0)	Jelly-fish unident	Other species
107	8/08	58°47'	164°51'	1449	14/17	7.8/7.3	0.42	0.1	-	-	-	-	1.4
108	8/08	58°19'	166°09'	2222	18/24	5.9/4.8	0.50	-	-	-	-	0.1	-
109	8/09	57°50'	167°27'	0556	11/36	7.8/-	0.20	0.9	<0.1	-	-	0.1	2.5
110	8/09	57°22'	168°40'	1130	21/40	8.7/8.5	0.25	16.3	-	0.3	-	14.7	0.2
111	8/09	56°55'	169°53'	1811	17/37	7.3/4.9	0.25	11.6	-	0.1	-	22.7	<0.1
112	8/11	57°09'	172°34'	1331	19/63	9.2/5.7	0.25	10.2	-	-	-	18.5	0.1
113	8/11	57°47'	170°55'	2042	23/46	-/3.8	0.17	4.9	<0.1	-	-	62.8	-
114	8/12	58°25'	169°14'	0411	12/36	8.8/0.7	0.17	7.8	-	-	-	90.0	1.1
115	8/12	58°56'	167°49'	1028	13/22	6.9/6.5	0.50	<0.1	<0.1	-	-	0.1	-
116	8/12	59°25'	169°53'	2034	12/32	9.6/-	0.17	4.8	-	-	-	17.1	0.4
117	8/13	57°28'	170°23'	1811	22/37	9.0/4.9	0.17	4.6	-	-	-	72.9	0.4
118	8/14	58°48'	171°31'	1348	25/48	8.8/0.7	0.35	3.7	-	-	-	87.1	<0.1
119	8/15	59°05'	174°05'	1117	34/66	9.2/2.2	0.33	15.7	10.0	-	-	3.4	0.2
120	8/15	59°38'	172°33'	1803	27/46	8.9/1.5	0.35	2.3	-	-	-	19.0	<0.1
121	8/16	60°13'	170°55'	0023	15/36	8.9/-1.1	0.37	-	-	-	-	0.2	3.6
122	8/16	60°41'	173°18'	1142	19/33	8.1/1.3	0.50	0.4	-	-	-	17.1	<0.1
123	8/16	59°59'	175°15'	1929	14/64	8.9/5.0	0.50	1.0	-	-	-	1.9	<0.1
124	8/17	59°18'	177°09'	0326	30/85	8.9/1.9	0.50	-	1.0	-	-	19.4	-
125	8/17	60°30'	177°16'	1744	44/82	8.8/0.7	0.50	-	6.0	-	-	7.0	0.5
126	8/18	61°07'	175°33'	0027	17/55	8.7/1.5	0.50	<0.1	37.0	-	-	3.8	3.4
127	8/18	61°43'	173°47'	0747	9/38	8.7/8.5	0.33	0.9	0.2	-	-	2.5	0.1
128	8/18	61°14'	174°18'	1259	13/43	8.5/6.0	0.25	2.5	-	-	-	7.8	-
129	8/19	58°11'	173°08'	1214	29/60	8.9/3.0	0.17	6.6	-	-	-	4.2	<0.1
130	8/19	58°31'	172°17'	1554	18/55	9.0/8.0	0.50	3.6	-	<0.1	-	20.2	0.4
131	8/19	58°14'	171°22'	2016	14/50	9.2/9.1	0.27	7.3	0.1	-	-	47.4	<0.1
132	8/20	57°50'	172°23'	0149	10/59	8.8/8.8	-	0.4	-	-	-	18.0	0.5
133	8/20	57°27'	173°20'	0646	16/69	8.7/8.5	0.33	0.3	-	-	-	28.4	0.7
134	8/20	57°29'	171°42'	1241	16/57	9.1/9.0	0.25	12.0	-	-	-	53.2	0.7
135	8/20	56°55'	171°24'	1709	20/62	8.8/5.0	0.30	9.0	0.2	<0.1	-	83.0	<0.1
136	8/20	56°35'	170°40'	2050	23/64	7.6/4.3	0.25	2.6	-	-	-	30.1	<0.1
140	8/22	56°38'	168°37'	1934	31/60	8.4/3.4	0.43	5.5	-	<0.1	-	70.8	<0.1
141	8/22	56°38'	168°40'	2022	15/60	8.4/8.2	0.17	7.2	-	0.1	-	49.4	-

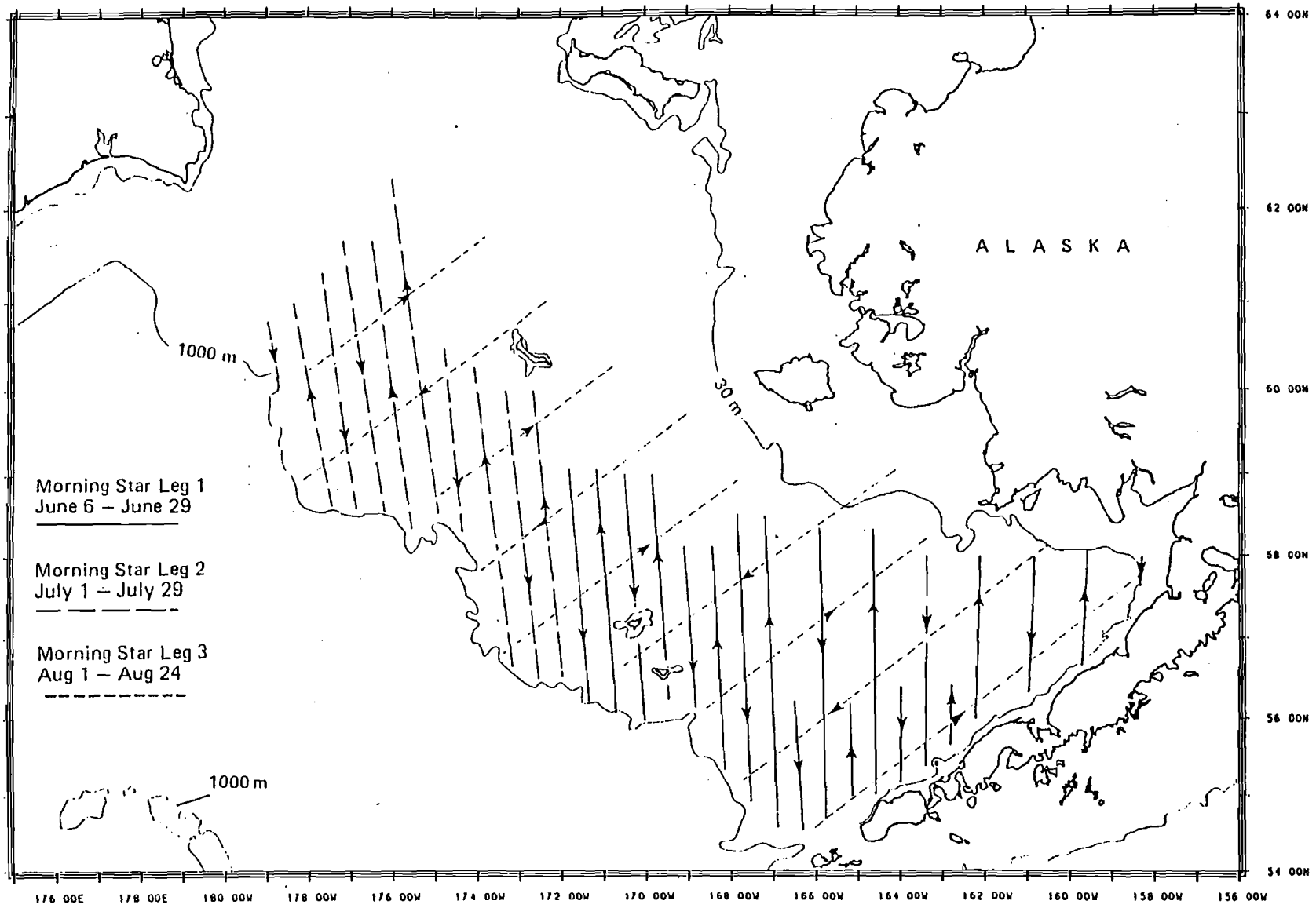

Figure 1 --Transects of the charter fishing vessel Morning Star during the 1985 midwater survey